

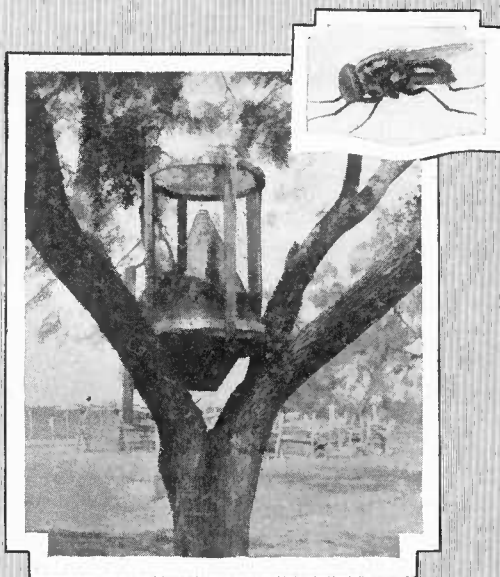
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SCREW WORMS AND OTHER MAGGOTS AFFECTING ANIMALS



THE SCREW WORM is an important pest of nearly all stock in the Southwest. In some sections the rearing of young calves is practically prevented by its ravages. Some grown stock are killed outright, some are maimed permanently, and infested animals always lose flesh and their milk production decreases. The expense of watching herds and treating infested animals also is considerable.

Several kinds of flies infest wounds and lay their eggs in the soiled wool on sheep. These flies may occur in any part of the United States. All breed in decaying animal matter, especially in carcasses of large animals. If all dead animals could be disposed of properly, no cases of infestation of living animals would occur.

Complete destruction of carcasses by burning is the approved method. This lessens danger of the spread of such diseases as anthrax and blackleg from animal to animal in pastures and prevents all breeding of flies in carcasses. If burning can not be carried out properly, bury carcasses, covering them with at least 2 feet of soil. Apply a liberal quantity of quicklime prior to covering, especially if a possibility exists that the animal died of some contagious disease.

Other steps to prevent infestation are avoiding injury to stock, having young come when flies are not abundant, destroying ticks, performing surgical operations in winter or early spring, and poisoning or trapping flies. To prevent attack by wool maggots, lamb early, avoid diarrhea, tag sheep if dirty, and breed hornless types.

In treating stock watch for the first signs of infestation, use benzol ("commercial 90 per cent") to kill maggots, and follow with pine-tar oil with a specific gravity of 1.065, which is heavier than ordinary commercial pine-tar oil and covers the wounds better.

Avoid the use of creosote stock dips and other worm killers containing phenols and cresols, as they are injurious to the animal.

SCREW WORMS AND OTHER MAGGOTS AFFECTING ANIMALS

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CONTENTS

	Page		Page
Distribution and abundance of the screw worm.....	1	Life history and habits.....	4
Character of injury and losses due to the screw worm.....	2	Control.....	5
Description of the screw-worm fly and its offspring.....	2	Other flies infesting wounds, including the sheep-wool maggots.....	9

THE so-called screw worm¹ is a pest of prime importance to the stock raisers of the Southwest. This insect gains its common name from the habit of the larvæ or maggots of penetrating practically sound tissue. Stockmen usually distinguish between the screw worm and what they term maggots largely by the character of the wound infested and the time of year. The screw worm is often confused with the other species, which commonly are spoken of as maggots, especially during the spring and fall months. Injury to livestock from maggots is more widespread than is that due to the true screw worm. In fact, this maggot injury may be found among livestock in any State of the Union, although it occurs most frequently in the warmer portions of the country. The true screw worm inflicts enormous losses on the stock raisers of Texas, Oklahoma, New Mexico, Arizona, and southern California during seasons which are favorable for its development. During the warmer portions of the year it is never entirely absent from this region and may also cause injury to stock in the other Southern States, and as far north as Nebraska.

The screw worm is a native of the Americas and has been causing trouble to stockmen for many years. No doubt it is largely owing to this fact that the cattlemen accept the pest as a necessary evil and always count upon "doctoring" a certain number of cases every year.

DISTRIBUTION AND ABUNDANCE OF THE SCREW WORM

The screw-worm fly occurs from the southern part of South America northward into Canada, but it seldom becomes abundant in the Northern States, and the fly itself is killed quickly by cold weather. Since 1843 it has been of more or less importance nearly every year in what are now the Southwestern States. At times it has become a serious pest farther to the north and east. For instance, in 1890 a rather severe outbreak was experienced in Louisiana and Mississippi, and very frequently it causes much annoyance to stock in Kansas.

In the Southeastern States cases of screw-worm injury are infrequent, except under certain local conditions.

The seasonal abundance of the screw-worm fly depends largely upon climatic conditions. The adults first appear in numbers in spring from the first of April to the middle of June, the date varying with the latitude and the earliness, or lateness of the season. Throughout most of the territory where it is a pest it usually becomes numerous during early May, and cases of screw-worm injury begin to appear soon after. The insect then gradually increases in numbers until the hot, dry weather of mid-summer, which in Texas usually reduces the abundance so that the injury is not severe under normal conditions in the months of July and August, unless considerable cloudy

¹ Known scientifically as *Cochliomyia macellaria* Fabricius.

and rainy weather occurs. It becomes more numerous again in the early fall, especially when the weather is warm and showery, and its activities are terminated only with the advent of heavy frosts. The abundance of this fly, of course, is dependent to a large extent upon the breeding places at hand, but it is also true that a warm, humid atmosphere is best suited to its development in carcasses.

CHARACTER OF INJURY AND LOSSES DUE TO THE SCREW WORM

Practically all animals are more or less subject to attack by the screw worm. Probably sheep, goats, and cattle suffer most, with hogs, horses,

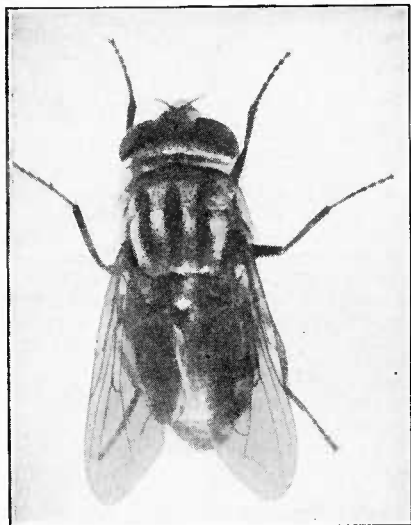


FIG. 1.—Screw-worm fly as seen from above.
Much enlarged

mules, and dogs following in the order named. Wild deer and many of the smaller mammals sometimes are seriously infested. Numerous cases of infestation of human beings have been recorded, and probably thousands of such cases have not been reported.

In man the nose and throat are most commonly infested, the cases occurring usually among individuals who suffer from chronic catarrh. Minor wounds on various parts of the body also are infested.

Among livestock the most common form of attack follows minor skin injuries, such as cuts by barbed wire and scratches from brush or from hooking. Often calves are attacked by the worms at the time of birth. In these cases the screw worms may

enter on various parts of the body, but most commonly at the navel, where they penetrate with ease. If not promptly treated, the calf may die. It is not infrequent to find infestations of the mouth, in some cases resulting in the loss of teeth or death. Cows frequently are infested on regions where blood collects at the time of calving. Where ticks are abundant, a common source of infestation is through the deposition of eggs on blood spots resulting from the crushing of engorged ticks. Most of the other infestations occur following surgical operations such as dehorning, castration, branding, etc. Some cases follow serious attacks of biting flies such as the horn fly, stable fly, and horse flies. The blood oozing from the punctures made by these flies attracts the screw-worm fly. Among hogs the worms usually gain entrance about the ears and head through scratches made in fighting. The most serious trouble among sheep and goats is from the infestation of cuts made in shearing.

In cases which are not treated the injury is gradually made worse by repeated laying of fresh eggs, the number of maggots being increased enormously. In such instances the animals lose appetite immediately, become emaciated, and hide away in the brush or some out-of-the-way place. This habit increases the chances of loss by death, especially where the ground is covered by heavy chaparral.

The death of animals is not infrequent, but the major portion of the loss is due to the reduction of flesh, the time required for riding ranges and treating animals, and the money spent for screw-worm medicines. During the summers of 1914 and 1925 the screw worms were so bad that many ranchers employed from 1 to 10 extra men, who were kept busy almost continuously on this line of work from May to November. A further loss of no small amount results from the practical prohibition of the breeding of cattle in certain districts, especially in parts of southwestern Texas, where stockmen have practically discontinued the attempt to raise calves and are buying up yearlings or other older animals and bringing them in for grazing.

DESCRIPTION OF THE SCREW-WORM FLY AND ITS OFFSPRING

All flies pass through the following four changes in the course of their lives: (1) The adult or mature insect, (2) the egg, (3) the larva, which is known as the maggot or worm, and

(4) the pupa, which is an inactive stage in which the change from the maggot to the adult fly takes place. The pupa stage corresponds to the chrysalis of a butterfly. A few kinds of flies have the habit of retaining the eggs within the body until they hatch and then depositing the minute but active maggots.

THE ADULT, OR FLY

Of the flies that breed in wounds on animals, the screw worm is of paramount importance, and all stockmen should learn to distinguish this fly from others. It is one of the most common of the so-called blowflies in the Southwest during the summer and fall months, although in the summer it is more or less common in practi-

side. (See fig. 2.) They are laid in irregular masses, sometimes several thousand being deposited in a mass by a number of females.

THE LARVA, OR MAGGOT

The maggots of the flies which infest wounds of animals are all very similar in appearance. Ordinarily the differences among them can not be distinguished without a very careful examination under a microscope. Their habit of attack, however, indicates with some degree of accuracy whether they are screw worms or some other species. All have the usual maggot shape and are nearly white. When newly hatched from the egg they are extremely minute and active, and when full grown they be-

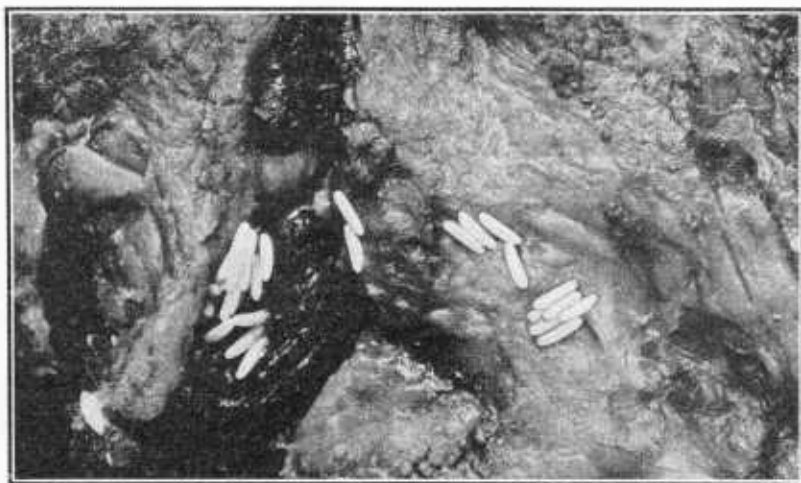


Fig. 2.—Eggs of the screw-worm fly on carrion. Considerably enlarged

cally all parts of the United States. Sometimes it is spoken of by observant stockmen as the "red-head," on account of the rather conspicuous red or yellowish-red coloring of the face. It is considerably larger than the common house fly, of a dark bluish green color, with three distinct black stripes on the back between the wings, as shown in Figure 1 and on the title page.

THE EGG

The eggs of the screw-worm fly are very similar in appearance to those of other blowflies. They are about a sixteenth of an inch long and creamy white in color. Most of them are somewhat curved and have a slightly projecting double ridge along one

come nearly three-fourths of an inch long. Although they have no legs, the body is fitted with minute spines and humps which enable them to crawl and aid them in working their way into an animal or any material upon which the flies are breeding. The head end is rather pointed and provided with two stout black hooks which are used in tearing the food. The larger or tail end is provided with two brownish plates through which they breathe (fig. 3). It is this portion of the maggot which is seen when one observes a mass of them in a wound.

THE PUPA

The pupa, or resting stage, usually is to be found in the ground. The

pupæ are somewhat barrel shaped, with the ends rounded. They are about one-third of an inch long (fig. 4). At first they are yellow, but later they turn to a rich brown color. When the fly within is mature it splits one end of the shell and crawls out.

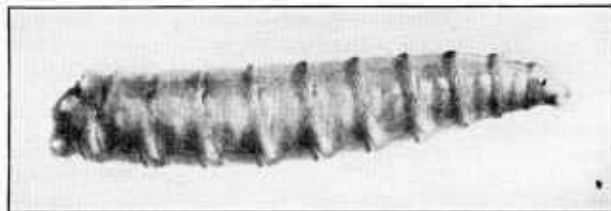


FIG. 3.—Screw-worm maggot, side view. Enlarged

LIFE HISTORY AND HABITS

With the advent of warm weather the flies appear and begin breeding in any available decaying animal matter. The question of where screw-worm flies breed is one of greatest importance to stockmen. Many are of the opinion that they do not breed in carcasses, but aside from the few which mature in living animals this is the only medium in which breeding occurs.

The life of the adult fly is comparatively short, ranging from a few days in extremely dry, hot weather to six weeks. The flies feed upon various kinds of refuse and to some extent upon the nectar of flowers. When food is not at hand and the temperature is high the flies usually die in from 24 to 48 hours. Eggs are laid in batches from one to four days apart, each mass containing from 40 to 250 eggs. A single female is capable of depositing as many as eight batches of eggs, the total number in one case being 1,228.

The eggs are deposited almost exclusively upon dead animals and in the wounds of living animals. The flies show a marked tendency to visit fresh carcasses rather than old ones; this is true also to some extent with the infestation of wounds. The eggs hatch in from less than four hours under moist and warm conditions to about two days when surroundings are less favorable. The condition which exists in fresh wounds is very favorable for incubation, and the eggs probably hatch within one or two hours after deposition in such situations.

As soon as the eggs hatch, the young larvæ begin penetrating the carcass, or if on living animals they start burrowing into the flesh. While undergoing development in a wound the larvæ tear the softer portions of exposed flesh with their stout jaws. When the maggots are working in a

deep wound they release their hold on the flesh at intervals and come to the surface, where they lie with the breathing pores exposed. If disturbed while at the surface, they return at once to the deeper portions. The injury to the infested animal is not due

entirely to the eating away of the tissues, but also to the bacteria and the toxic material resulting from the presence of the maggots in the wound, which may result in general poisoning of the system of the animal.

The worms grow very rapidly and in living animals are mature and drop from the wound in from 4 to 5 days. In carcasses they do not mature so rapidly (6

to 20 days) unless the weather is hot and damp. The grown maggots burrow into the ground to a depth of from 1 to 4 inches and soon contract, becoming first yellowish and then brown, the outside skin forming a hard protective covering. This is known as the pupa stage. The flies emerge from these pupæ in from 3 to 14 days and soon are ready for egg laying (fig. 5). The entire life cycle is completed in from one to four weeks, depending on the temperature and humidity.

The multiplication of screw-worm flies would be enormous if carcasses for their breeding were present. Careful estimates indicate that as many as a million flies may be produced from the body of a single cow.



FIG. 4.—Pupa, or resting stage, of the screw worm. Enlarged

CONTROL

The importance of destroying carcasses of all sorts of animals can not be overestimated. If all dead animals could be burned within a few days after death, trouble from screw worms in living animals would be unknown. It is realized fully that the obstacles to the carrying out of this method of control are many.

BURNING OR BURYING CARCASSES

The complete destruction of all dead animals by burning is by far the best method of control. This not only stops the breeding of all blowflies but helps to prevent the dissemination of such dangerous diseases of livestock as anthrax or charbon, blackleg, and hog cholera.

The method of burning carcasses depends to some extent upon the locality. Where wood is at hand, the expense is almost negligible. It is desirable that carcasses be burned without moving them, and in cases of death from anthrax this is imperative. The best plan is to dig a trench in the ground back of the carcass about equal to the size of the animal, fill this with wood, and turn the animal over on top of it. Start fire so that the wind will drive it under the carcass (fig. 6). Usually one-fourth of a cord of wood will completely consume a large carcass without further attention except to place the head and feet on the fire (fig. 7) a few hours after it is started. A very satisfactory method where stable manure is at hand is to place a large load of dry manure on top of the carcass and set it afire. This burns slowly and usually the animal is entirely destroyed without further attention. In some districts the use of crude oil or kerosene and a small quantity of wood makes the burning quick and inexpensive. It is important that the entire carcass be consumed, as a body charred on the outside will often be more effective in breeding screw worms than if it had not been burned at all. Complete destruction is essential also to control disease.

If burning is impracticable, carcasses may be buried. It is necessary to cover the top of the maggot-infested carcasses with at least 2 feet of closely packed soil to prevent the escape of flies. If no eggs are deposited on a dead animal it is not necessary to bury it so deep, but it is desirable to cover

it well to prevent dogs or other animals from digging it up. The free use of quicklime on the carcass before covering it will destroy some of the maggots and disease germs.

If it is absolutely impossible to burn or properly bury a carcass, many maggots can be destroyed, especially during the hot, dry weather of midsum-



FIG. 5.—Screw-worm flies on weed near carcass. All vegetation around this weed was covered in a similar manner. Considerably reduced

mer, by exposing the carcass in the sun. Dragging an animal into a creek bottom and leaving it in the shade of brush and trees is most conducive to screw-worm propagation. Some have suggested the cutting up of a carcass and scattering it about so as to hasten its drying. This would cause the destruction of some flies by the heat and

would enable birds and other natural enemies to destroy some of the maggots, but it is really not a commendable practice.

Animals found dead in water holes should be removed at once and destroyed. Screw-worm breeding will go on unless the body is submerged completely, and there is great danger of contaminating the water with disease which may kill many healthy stock.

AVOIDING SCREW-WORM ATTACK

Some slight modifications in the range or farm methods of handling

pearance of the trap is shown on the title page of this bulletin. The outside cylinder is 24 inches high and 18 inches in diameter, and the cone is the same diameter as the cylinder at the base, and reaches upward to within 2 to 4 inches of the top of the trap. The hole in the top of the cone is about 1 inch in diameter. The legs are 1 to 1½ inches long, and the top of the trap is covered with screen so that the flies will be attracted upward to the light. The top of the cone may be made removable to permit emptying.

Bait is placed under the trap in a pan 12 to 14 inches in diameter and 1



FIG. 6.—Carcass on wood in trench ready for burning. One-fourth of a cord of wood is sufficient for a large animal

livestock will tend to reduce the number of screw-worm cases.

FLYTRAPPING

As a supplementary measure for reducing the number of screw worms and other blowflies, flytraps such as the hoop trap recommended by the Department of Agriculture (see Farmers' Bulletin 734) may be utilized. Certain commercial firms are now building and selling traps made of galvanized iron, according to the specifications given in this bulletin. Some readers, however, may desire to get the bulletin and construct traps themselves or have them made locally. The general ap-

pearance of the trap is shown on the title page of this bulletin. The outside cylinder is 24 inches high and 18 inches in diameter, and the cone is the same diameter as the cylinder at the base, and reaches upward to within 2 to 4 inches of the top of the trap. The hole in the top of the cone is about 1 inch in diameter. The legs are 1 to 1½ inches long, and the top of the trap is covered with screen so that the flies will be attracted upward to the light. The top of the cone may be made removable to permit emptying.

Bait is placed under the trap in a pan 12 to 14 inches in diameter and 1 to 2½ inches deep. The bait pans may be made of galvanized iron, or lard-bucket covers may be utilized. For range use the deeper pans are best. The type of construction and dimensions of the trap and bait pan as given above should be closely followed, or best results will not be obtained.

By placing these traps in convenient places in the pasture, particularly near watering places where they may be visited regularly by riders, a large number of screw worm, wool maggot, and other flies can be destroyed. It is best to place the traps on platforms about 2 feet square attached to trees

or on the tops of fence posts about 3 to 5 feet from the ground and in places protected from strong winds and the sun.

The traps may be baited with carcasses of freshly killed animals, such as rabbits, prairie dogs, or domestic animals culled from the herds and flocks. The quantity of bait used depends to some extent on the frequency of rebaiting. From 2 to 5 pounds may be used in a bait pan at one time. During hot, dry weather especially, the bait should be surrounded by water to prevent it from drying out. The baits should be changed at least every week; oftener if maggots are found to

bring the flies together in great numbers. It also has the advantage of being easily carried on the saddle, is not unpleasant to handle, and if kept moist will remain attractive for two to three weeks. The cost is between 50 and 65 cents per pound, and a number of large cities have egg-drying plants where the material can be purchased. Since bakers use dried eggs to some extent, sources of supply can often be determined through them.

The dead flies should be removed from the trap when they have reached a depth of 8 or 10 inches around the cone. It is usually not necessary to kill the flies, as they die rapidly in



Fig. 7.—After burning for a few hours a carcass is consumed except the head and feet, which are then put on the fire and burning is completed without additional wood

be developing rapidly in them. To prevent maggot breeding the baits may be surrounded with a borax solution—1 ounce of powdered borax to each gallon of water, or nicotine sulphate may be added to the water at the rate of 1 teaspoonful to the quart. Commercial dried whole egg has been found to be an excellent blowfly bait. The egg is placed in the bait pan at the rate of 3 ounces to each quart of water. Ordinarily 6 ounces makes a very satisfactory bait. A teaspoonful of baking soda is added and the mixture stirred well. This material is not very attractive for the first day or two, but when decomposition starts it

the traps. The escape of the living flies can be prevented largely by inverting the trap, removing the top, and shaking the dead flies out. The top should be replaced before the trap is righted.

In trapping flies, as well as in the work of carcass destruction, concerted effort on the part of the stockmen in a considerable area is very desirable.

It must be remembered that traps which are not kept properly baited and in good condition will not catch flies. In work covering a given area it is considered advisable for the stockmen to organize, and to hire a competent man to look after the traps.

It is probable that one man with an automobile can attend to 250 to 300 traps, even in rough country. In such cooperative work it is probably best for the ranchmen to furnish cull goats and sheep which can be cut up and used for bait.

POISONING FLIES

A method used to some extent by certain stockmen consists in suspending the carcass of a sheep, goat, or other small animal so that about one-half of it is submerged in a tub containing a weak poison solution. Ordinary arsenical dip as used for cattle ticks, when diluted at the rate of 1 gallon of the dip to 6 gallons of water, gives good results. So-called hide poisons (sodium arsenite) may be used at the rate of 1 fluid ounce to 5 gallons of water. The flies are attracted to the decaying meat and usually feed upon the poison solution before leaving. These poisoned baits must be protected from stock, and chickens should not be allowed to feed on the dead flies. Most liquid poisons evaporate so rapidly that they are of little use under range conditions.

CONTROL OF TIME OF CALVING

Even in the most heavily infested districts, losses from screw worms at calving time can be largely avoided by having the calves drop between December 1 and the middle of April. In the northern portions of the screw-worm district this time can be extended from about November 1 to June 1. Of course this changes the present common range practice of allowing bulls to remain with the herd continuously, and its successful prosecution would depend to a large extent upon having some feed at hand for use during the calving period.

TIME FOR BRANDING, MARKING, CASTRATING, AND DEHORNING

Under present conditions most cattlemen avoid branding and castrating during the period when screw worms are most abundant. If all of these operations could be carried out between December 1 and May 1 very little trouble from screw worms would follow, but the period for dehorning should be shortened to avoid maggot infestation.

By rubbing a small quantity of cottonseed oil containing 4 per cent of carbolic acid over the burn imme-

diately after branding, healing is hastened and the scab peels off smoothly.

AVOIDANCE OF INJURY TO STOCK

It is important that all forms of injury which induce screw-worm infestation be avoided during the summer months. Greater care exercised in handling cattle will result in fewer scratches and bruises. Systematic dehorning of all cattle will largely prevent one source of injury, namely, that from hooking. This also tends to prevent some barbed wire and other scratches which result from animals endeavoring to escape the horns of others.

Careful shearing of sheep and goats so as to avoid cuts will largely reduce the number of screw-worm cases in these animals. The use of clippers which do not shear too close greatly reduces the number of wounds. Cuts from shears should be treated with a repellent immediately if screw-worm flies are present.

It is important that all corrals and pens be examined occasionally and projecting points, nails, and wire likely to cause injury to stock removed. A few minutes spent in this way will often save hours in treating screw-worm cases. Where practicable, smooth or woven wire should be substituted for barbed wire.

CLEARING OF PASTURES

Since dense brush and undergrowth are favorable to screw-worm breeding, every effort should be made to improve this condition. Although clearing of lands is more applicable to small pastures, some large stock raisers now have cleared thousands of acres of the most dense undergrowth. This procedure increases the grass production, makes the finding of dead animals or wormy animals more easy, and facilitates the handling of stock on the ranges.

DESTRUCTION OF TICKS

A large percentage of screw-worm infestation follows tick attacks. Where systematic dipping for ticks is carried out, the number of cases of screw worms is materially reduced. Heavy infestations of ticks other than the cattle tick² often are followed by an infestation of screw worms. This is true of the Gulf Coast tick,³ and ear tick,⁴ which attack the inside of the

² *Margaropus annulatus* (Say).

³ *Amblyomma maculatum* Koch.

⁴ *Ornithodoros megnini* Dugès.

ears of various animals. Although the usual system of dipping will not completely destroy these and ticks other than the cattle tick, it will reduce their numbers markedly. Furthermore, where cattle infested with screw worms are dipped in an arsenical solution, many of the maggots are killed.

TREATMENT OF INFESTED ANIMALS

It is important that herds be watched carefully during the screw-worm season so that all cases of infestation may be detected early. Those familiar with screw-worm injury have very little difficulty in telling if a wound is infested. Usually there is a free discharge of watery fluid and blood and a fresh appearance to the wound. In handling these cases on ranches it is best to have a small pasture, usually called a "trap," close to headquarters, where all infested animals are kept until the wounds are completely healed.

The construction of large cages of screen wire or netting such as shade cloth, used in covering tobacco, has been found practicable for the protection of valuable calves born in the screw-worm season. Moreover, such cages are useful for protecting injured stock from infestation or for allowing wounds already infested to heal following treatment without suffering further attack.

For destroying the maggots in a wound, nothing better than benzol has been found. There are several grades of benzol on the market, but for killing screw worms the "commercial 90 per cent benzol" is best. This material has a number of distinct advantages over other larvicides. It does not injure the tissues, kills the larvæ rather rapidly, is comparatively inexpensive, and does not deteriorate upon standing. If there is a comparatively small hole in the skin at the site of infestation it is best to put a small quantity of the benzol into the hole and plug it with cotton. Benzol does not mix readily with blood or serum, hence it is necessary to remove the free exudate with cotton before applying the benzol. In the case of valuable animals, after the maggots are dead it is best to remove them with a pair of forceps, and the wound then may be washed with a good dis-

infectant solution, care being taken not to start bleeding. After this the wound and soiled area about it should be coated with commercial pine-tar oil (specific gravity 1.035) or a slightly heavier grade of pine-tar oil (specific gravity 1.065). A mixture consisting of 10 parts of either of these pine-tar oils and 1 part of furfural has also been found to be a very effective repellent. Tannic acid dusted over a fresh wound will check bleeding, make it less attractive to flies, and make the pine-tar oil adhere better. When a wound is severe it is best to call in a competent veterinarian, especially if the infested animal is a valuable one.

Chloroform, while fresh, is an effective worm destroyer, but there are several objections to its use. The use of various stock dips for killing screw worms is objectionable, since the tissues of the animal are injured, large swellings may be produced, and the animals are sometimes killed from the absorption of the phenols.

When it is necessary to perform any surgical operation during the fly season it is best always to apply pine-tar oil as mentioned above to avoid screw worms. Tannic acid may be used to check bleeding before the repellent is applied.

OTHER FLIES INFESTING WOUNDS, INCLUDING THE SHEEP WOOL MAGGOTS

The screw-worm fly⁵ is the only species in this country the larvæ of which penetrate the sound tissues of living animals. Four or five other kinds of flies have been bred from maggots taken from wounds of different types and also from soiled wool on sheep. With all of these flies there seems to be less tendency to attack fresh wounds, the attraction for them increasing as the wound becomes foul and bad odors develop.

INJURY AND LOSSES DUE TO MAGGOTS

The injury produced by various species of fly larvæ other than the screw worm may be divided into two classes—(1) that which results from attack in wounds and (2) infestation of the wool of sheep. The same insects may be concerned in both of these. The first type of infestation usually is to be found in large wounds or old sores. Probably the most common place of attack is in the heads of ani-

⁵ Cattle grubs or "wolves" cut through the unbroken skin, but the injury produced by them is entirely different from that discussed here. See Department Bulletin No. 1369 for information on these insects.

imals following dehorning, and any old festering sore may become infested. When maggots become established after dehorning, the healing process usually is greatly delayed, but it is not usual for animals to die, especially if they receive some attention. The loss due to wool maggots is of considerable importance. It probably is greatest in certain sections of the Southwest, but this class of injury is not uncommon in the Central States and California. One of the most serious problems with which the sheep raiser in Australia has to deal is very similar to this one, although in that region the number of different species



FIG. 8.—The black blowfly or common wool-maggot fly of the United States, as seen from above. Enlarged

of maggots attacking the wool of sheep is much greater and the infestation of flocks is more general. In this country, although a few cases occur nearly every year following lambing, it is only when favorable weather conditions prevail that the injury becomes serious. In such cases a large percentage of ewes may become infested about the rump following lambing. Some are killed outright, nearly all are cut down in flesh, and the loss in wool sometimes amounts to nearly half of the entire clip on the ewes infested. The cost of treatment and material used in destroying the maggots is considerable under such conditions.

Another common place of attack by these maggots is in the wool surrounding the horns. The blowing is usually started by the presence of slight injuries around the horns caused by fighting. Some cases of maggots follow the soiling with excrement of the wool about the vent. This usually occurs when sheep are sick and have diarrhea.

The eggs are laid on the soiled wool, and the small maggots upon hatching work into the wool. Many of them feed next to the skin, and soon the wool is loosened in large patches and the skin made red and raw. The odor from the infested area is strong, and other flies are attracted to deposit their eggs. As the irritation increases the flesh is entered, and the sheep often die.

SPECIES OF FLIES INVOLVED

THE BLACK BLOWFLY⁶

The fly which is responsible for most of the trouble from wool maggots, especially in the Southwest, is the black blowfly. It is the maggot of this fly which is commonly found in old festering sores and following dehorning, except when this operation is done during the summer time in the Southwest, when the screw worm is the species concerned.

This fly usually becomes active during warm days in the winter and multiplies rapidly in the early spring, but the hot dry weather of summer soon reduces its numbers so that in the Southwest it may disappear completely for a few months. It again increases in numbers during the fall, and after about November 1 largely takes the place of the screw-worm fly as a carrion breeder.

The adult is about the same size as the screw-worm fly, but it is greenish-black in color and has no stripes on the back. (See fig. 8.) It should not be confused with the large hairy blowfly⁷ or the blue-bottle flies,⁸ which are often seen in or around houses during the fall, winter, or early spring months. These blowflies usually are larger in size, more hairy in appearance, and have grayish colored thoraxes and dark-blue or silvery-blue abdomens.

The breeding habits of the black blowfly are very similar to those of the screw-worm fly. It is exclusively

⁶ *Phormia regina* Meigen.
⁷ *Cynomyia cadaverina* Desv.

⁸ *Calliphora* spp.

a flesh breeder, but occasionally it may develop in very old decaying carcasses. The eggs, which are deposited in masses, hatch in from less than 24 hours to 4 days. The maggots become fully developed in 3 or 4 days after hatching and begin to crawl away and burrow into the earth. The pupa stage lasts from 7 to 10 days, and after the fly emerges a week or more usually elapses before the first eggs are laid. On living animals the rate of development is probably somewhat faster. By this rapid breeding the flies may become very abundant during the early fall before cold weather sets in.

THE GREEN-BOTTLE FLY⁶

The green-bottle fly has a wide distribution throughout the world. It is known as the green-bottle or green blowfly in this country. It is rather closely associated with habitations of man and is not so commonly found on the range as are the screw-worm fly and the black blowfly. It is often abundant in cities, especially if garbage is not properly cared for.

This is the fly which causes the wool maggot of sheep in the British Isles, and the same habit has been recorded for it in this country. It has been known to deposit eggs on the soiled rumps of calves as well as sheep, following diarrhea, and occasionally it infests wounds on animals, but it is not so injurious as are the two species previously described.

It is usually slightly smaller than the black blowfly and the screw-worm fly (fig. 9). Its color ranges from a brilliant green to a metallic green. It is without stripes or other markings.

The adult flies usually appear during the first warm days of spring and are present throughout the summer, though they seldom become as numerous as the screw-worm fly or black blowfly. The length of time required for development is about the same as that required by the black blowfly. The maggots breed almost exclusively in animal matter.

THE GRAY FLESH FLIES

There are two or more species⁷⁰ of this group of flies which occasionally breed in living animals, apparently attacking only old festering wounds.

They are of comparatively little importance, and since there are a great number of different kinds of flies of this group, some of which are not at all injurious, it is hardly necessary that the stockmen learn to recognize them. Their size varies considerably from a little larger than the common house fly to somewhat larger than the black blowfly. The color usually is uniformly gray, with black stripes on the back, and the abdomen is often checkered. One of these flies is shown in Figure 10.

Many of the members of this group of flies retain the eggs in the abdomen until they hatch, and thus bring forth living maggots. Those species which



Fig. 9.—The green-bottle fly. Enlarged

attack living animals breed in decaying animal matter and their life history is almost the same as that of the screw-worm fly. The flies seldom become very numerous, and in most of the cases in which they are found in living animals they are located in old festering wounds or the young are deposited after a sore has become infested by screw worms. These flies seem to be able to withstand the hot, dry weather of midsummer in the Southwest and probably are responsible for many of the cases of infestation of animals during such periods.

⁶ *Lucilia sericata* Meigen. The bronze-green fly *L. cuprina* Wied. is abundant in the Southwest and has habits similar to those of *L. sericata*.

⁷⁰ *Sarcophaga texana* Aldrich, *S. tuberosa* var. *sarracenioides* Aldrich, and *S. robusta* Aldrich.

METHOD OF CONTROLLING MAGGOTS

The black blowfly, the green-bottle fly, and the flesh flies are carrion breeders. They attack wounds on living animals mainly as a result of the presence of the flies in abnormally large numbers. Therefore it is clear that practically all of the methods of control recommended for the screw worm are equally applicable to the other species of noxious flies. To prevent the breeding of the black blowfly it is essential that carcasses be burned or buried, even during the winter months. Thus the proper disposal of

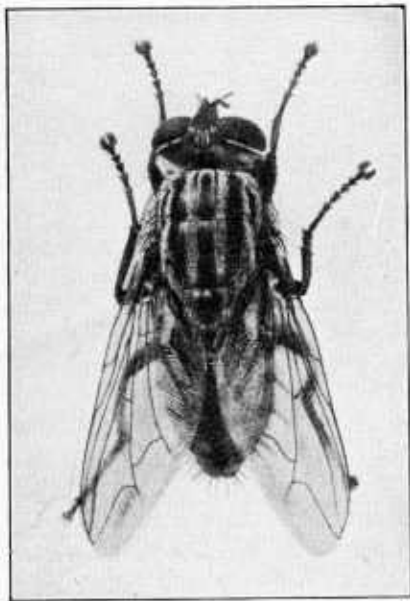


FIG. 10.—A gray flesh fly (*Sarcophaga* sp.)
Enlarged

carcasses becomes of much importance all the year. Where these flies become a nuisance by contaminating food products or by entering houses, which is usual in towns or cities, attention must be given to the proper disposal of garbage, as they will breed in the meat scraps in garbage cans or on dumps as well as in carcasses.

THE PREVENTION AND TREATMENT OF MAGGOTS IN WOUNDS AND FLEECE

To destroy maggots in sores the same method as for the screw worm is to be followed. It is not always possible to prevent maggot infesta-

tion following dehorning, but if periods of cool weather in winter are chosen for this operation, usually no trouble follows. To prevent maggots from gaining entrance to wounds the application of commercial pine-tar oil is advised. Following dehorning, some persons advise covering the wounds with pieces of cloth dipped in pine tar. In many cases these will remain in place several days.

The tails of lambs are sometimes infested by maggots following docking. Whether docking is done with a knife or by burning it is advisable to apply commercial pine-tar oil to the stub. The docking of lambs tends to avoid the soiling of their wool during succeeding months, and this helps to prevent infestation of the rump by maggots. Other important steps in preventing wool-maggot injury are the following:

(1) Trim off the soiled wool about the vent and along the hind legs. This tagging can be done at a very reasonable expense at the time goats are sheared where goats and sheep are kept on the same ranch. The goat shearing is usually done before cases of wool-maggot infestation begin to appear.

(2) Breed hornless sheep and thus avoid injury from horns and consequent infestation around them.

(3) Lamb as early in the spring as possible, other conditions being considered.

(4) Shear either before lambing, if lambing is late, or as soon after as possible, and thus avoid the infestations which almost invariably follow in heavy-wool sheep when warm, humid weather comes on.

In Australia very extensive work has been done looking toward the destruction of maggots in wool, but nearly all the remedies devised have objections, so that dependence must be placed almost entirely upon preventive measures.

If sheep become infested, however, the wool should be clipped from about the portions containing the maggots. It is necessary to begin the clipping outside the infested area, so as to avoid driving the maggots back into the unsoiled wool and thus extending the trouble. When the maggots have been concentrated in a certain spot by clipping around them, the application of benzol or chloroform will destroy the maggots, and the entire mass then can be clipped off. It is

important that something be applied to deodorize the infested parts and hasten healing. Some sheepmen apply air-slaked lime for this purpose, but this is somewhat irritating, and often forms crusts which crack later and induce reinfestation. A dressing of commercial pine-tar oil is probably the most effective for protection against flies. If this is applied carefully the surrounding wool need not be soiled to a great extent.

On large sheep ranges, when the lambing is done during seasons which are favorable for infestations, it is

best to have the flocks divided into rather small units and carefully watched, so that any fly-blown sheep may receive immediate attention.

To protect lambs and other sheep during the summer months from being blown by green-bottle flies an effort should be made to prevent diarrhea, and when sheep get dirty they should be promptly trimmed up. Apply to the rump, and to the parts fouled by diarrhea, petrolatum containing a few drops of commercial pine-tar oil. The grease will hold the tarry odor in suspense and act as a fly repellent.

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